

**KING SAUD UNIVERSITY**  
**COLLEGE OF COMPUTER & INFORMATION SCIENCES**  
**DEPT OF COMPUTER SCIENCE**

**CSC311** Computer Algorithms

Third Semester 1444

Instructor: Prof. Mohamed Maher Ben Ismail

## Tutorial #1

1. Given the matrices A and B of sizes  $m \times l$  and  $l \times n$  respectively.
  - a) Write the pseudocode to compute the matrix  $C = A \times B$
  - b) What is the complexity of the code that you wrote?
2. Consider the following code fragment,

```
x ← 1  
for i ← 1 ..n step 3 do  
  x ← x + 2  
print x
```

What value of x will be printed (express it as a function of n)

3. Consider the following code fragment,

```
x ← 5  
i ← 1  
While (2 i < N) do  
  i ← i + 2;  
  x ← x + 3;  
  
print x
```

What value of x will be printed (express it as a function of N)

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4. Show that  $6n + 3n \log(n^5) = O(n \log n)$ . Find the appropriate values of  $C$  and  $n_0$ .
5. Show that  $2n^3 - 10n^2 + 2 = O(n^3)$ . Find the appropriate values of  $C$  and  $n_0$ .
6. Prove or disprove the statement,  $2^{n+2} = O(n^2)$ .
7. Prove that  $3^n = O(n!)$ . Find the appropriate values of  $C$  and  $n_0$ .
8. Compare the order of growth for  $3^{2n}$  and  $5^n$ .

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Q1. (a)

```
for i ← 1...n
  for j ← 1...n
    C[i,j] = A[i,1] * B[1,j]
return C
```

(b)  $\sum_{i=1}^m 1+1 = m+1$  for  $i \in 1 \dots m$

$\sum_{i=1}^m \sum_{j=1}^n 1+1$  for  $j \in 1 \dots n$

$m \cdot n$

$C[i,j] = A[i,1] * B[1,j]$

return C

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$\Theta(mn)$

$$2: 2 * n/3 + 1$$

$$3: 5 + 3[(n/2 * 1/2)]$$

Q 4:  $6n + 15n \log n \leq$   
 $6n \log n + 15n \log n$   
 $\leq 21n \log n$   
 $\quad \quad \quad \nwarrow$   
 $\quad \quad \quad c$

$c = 21$  So  $6n + 3n \log n$  is

$$O(n \log n)$$

$$5: 2n^3 - 10n^2 + 2 \leq 14n^3$$

$$C = 14 \quad n_0 = 2$$


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$$6: \lim_{n \rightarrow \infty} f(n)/g(n) \leq C$$

$$\lim_{n \rightarrow \infty} 2^{n+2}/n^2 \leq C$$

$$\lim_{n \rightarrow \infty} 2^{n+2}/n^2 = \infty$$

So it's not  $O(n^2)$

Disproved

$$2: 3^n \leq Cn!$$

$$3^n = 3 \times 3 \times 3 \quad \wedge \text{ No of 3's}$$

$$C n! = 1 \times 2 \times 3 \dots \times n$$

$$6 n! = 6 (1 \times 2 \times 3 \dots n)$$

$$= 3 \times 4 \times 3 \times \dots n \geq 3 \times 3 \times 3$$

$$3^n \leq 6!$$

$$C = 6$$

$$3^n = O(n!) \quad n_0 = 1$$

$$\partial: z^n - y^n$$

$$g^n \subseteq C * y^n \quad n \geq n_0$$

$$g^n \subseteq y * g^n$$

$$C = y \quad n_0 = 1$$

$$z^n \in O(y^n)$$

$$5^n \leq C 5^n \quad \wedge \quad n_0$$

$$5^n \leq 2 * 5^n$$

$$C = 2 \quad n_0 = 1$$

$$5^n \text{ is } O(5^n)$$

---

Both has exponential  
order of growth









# #

